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Owen et al.

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[45] **Date of Patent: Nov. 3, 1992**

[54] **METHOD FOR ADHESIVELY BONDING A RAIL-TIE FASTENING ASSEMBLY TO A WOODEN RAILWAY TIE**

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[73] Assignee: **Kerr-McGee Corporation**, Oklahoma City, Okla.

[21] Appl. No.: **819,578**

[22] Filed: **Jan. 8, 1992**

Related U.S. Application Data

[63] Continuation of Ser. No. 414,226, Sep. 29, 1989, abandoned, which is a continuation-in-part of Ser. No. 128,174, Dec. 3, 1987, Pat. No. 4,874,128.

[51] **Int. Cl.**[5] **E01B 2/00**; E01B 9/00

[52] **U.S. Cl.** **238/310**; 156/322; 144/348; 238/DIG. 1

[58] **Field of Search** 238/83, 264, 265, 283, 238/DIG. 1, 310; 156/257, 321, 322, 306.3, 306.9; 144/348; 34/13.8; 29/DIG. 1

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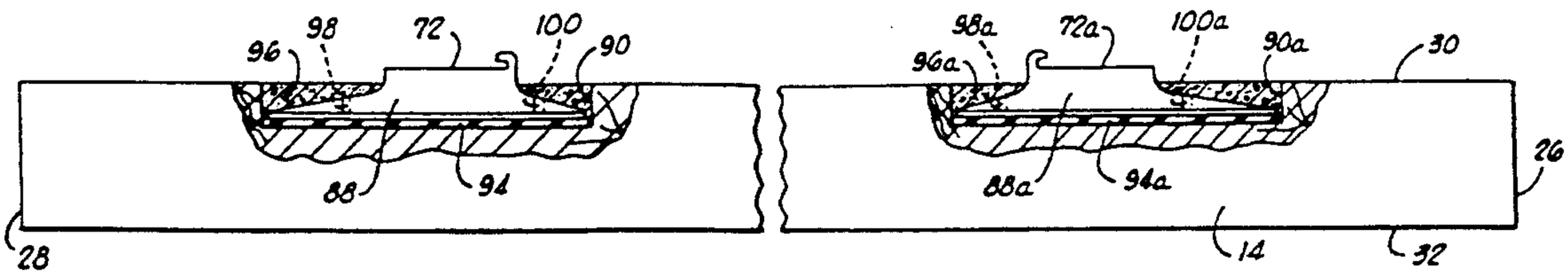
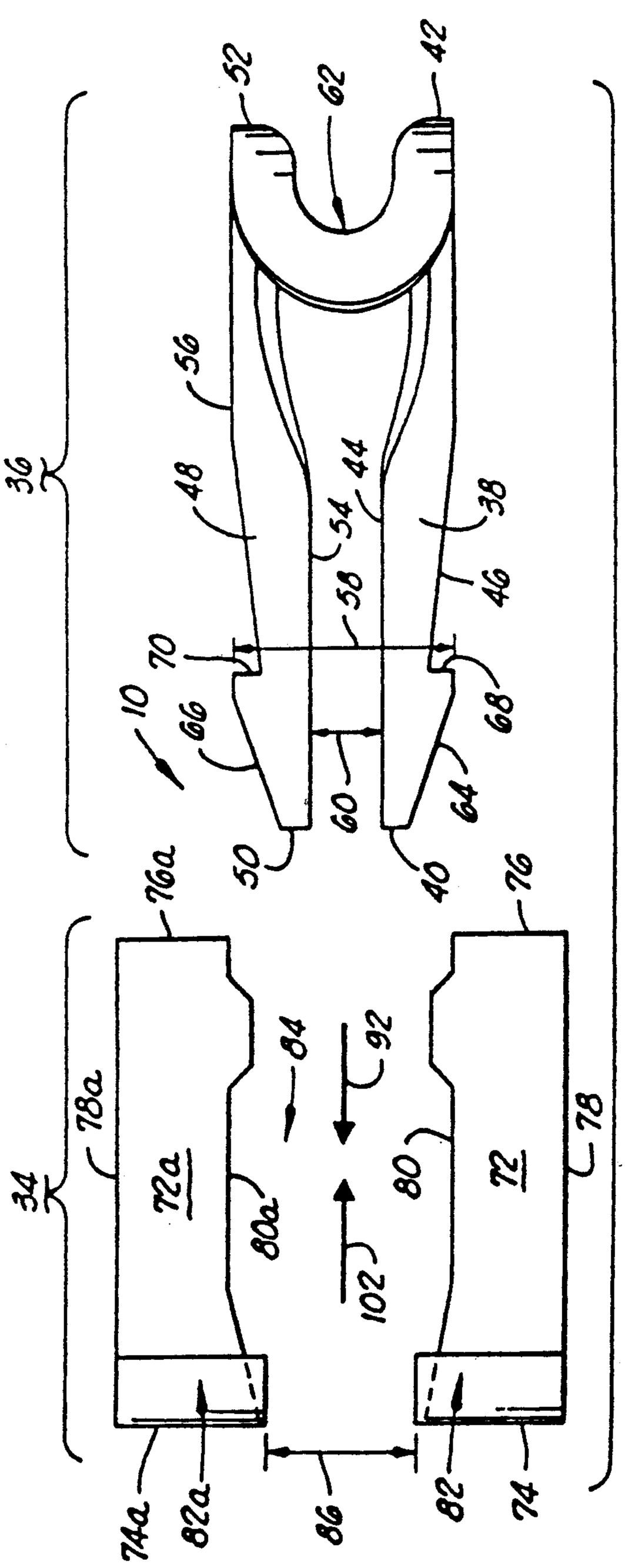
Assistant Examiner—James Eller
Attorney, Agent, or Firm—Herbert M. Hanegan

[57] **ABSTRACT**

A rail-tie fastening assembly for connecting a rail having a rail flange to a tie comprising a rail seat assembly and a rail anchor. Th rail seat assembly is connectable to the tie and includes an anchor slot and a seat hook assembly. The seat hook assembly is adapted to extend a distance over an upper surface of the rail flange. The rail anchor includes an anchor hook assembly adapted to extend over on the upper surface of the rail flange in an assembled position of the rail anchor to the rail seat assembly. The rail anchor is insertable through the anchor slot in the rail seat assembly to the assembled position. The seat hook assembly is spaced a distance from the upper surface of the rail in the assembled position of the rail anchor to the rail seat assembly. The anchor hook assembly engages one side of the rail flange and the seat hook assembly engages the opposite side of the rail flange to restrain lateral movement. A base anchor is connected to the rail seat assembly and the base anchor is disposable in a cavity formed in an upper surface of the tie and the base anchor is secured to the tie, thereby securing the rail seat assembly to the tie.

2 Claims, 6 Drawing Sheets

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62
42
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50
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76a
76
34
78a
72a
80a
84
92
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72
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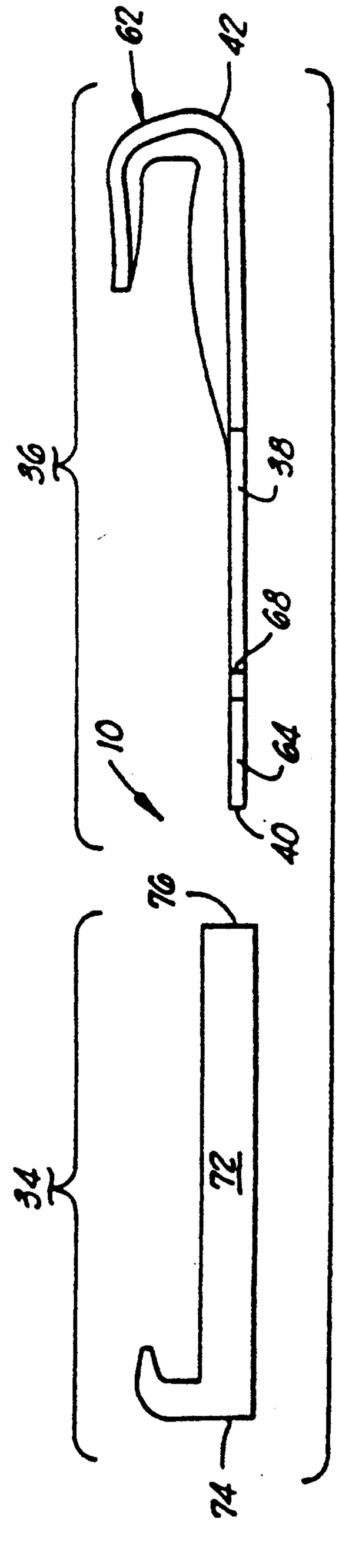
102
74a
82a
86
82
74

FIG. 1


62
42
36
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68
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64
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76
34
72
74

FIG. 2

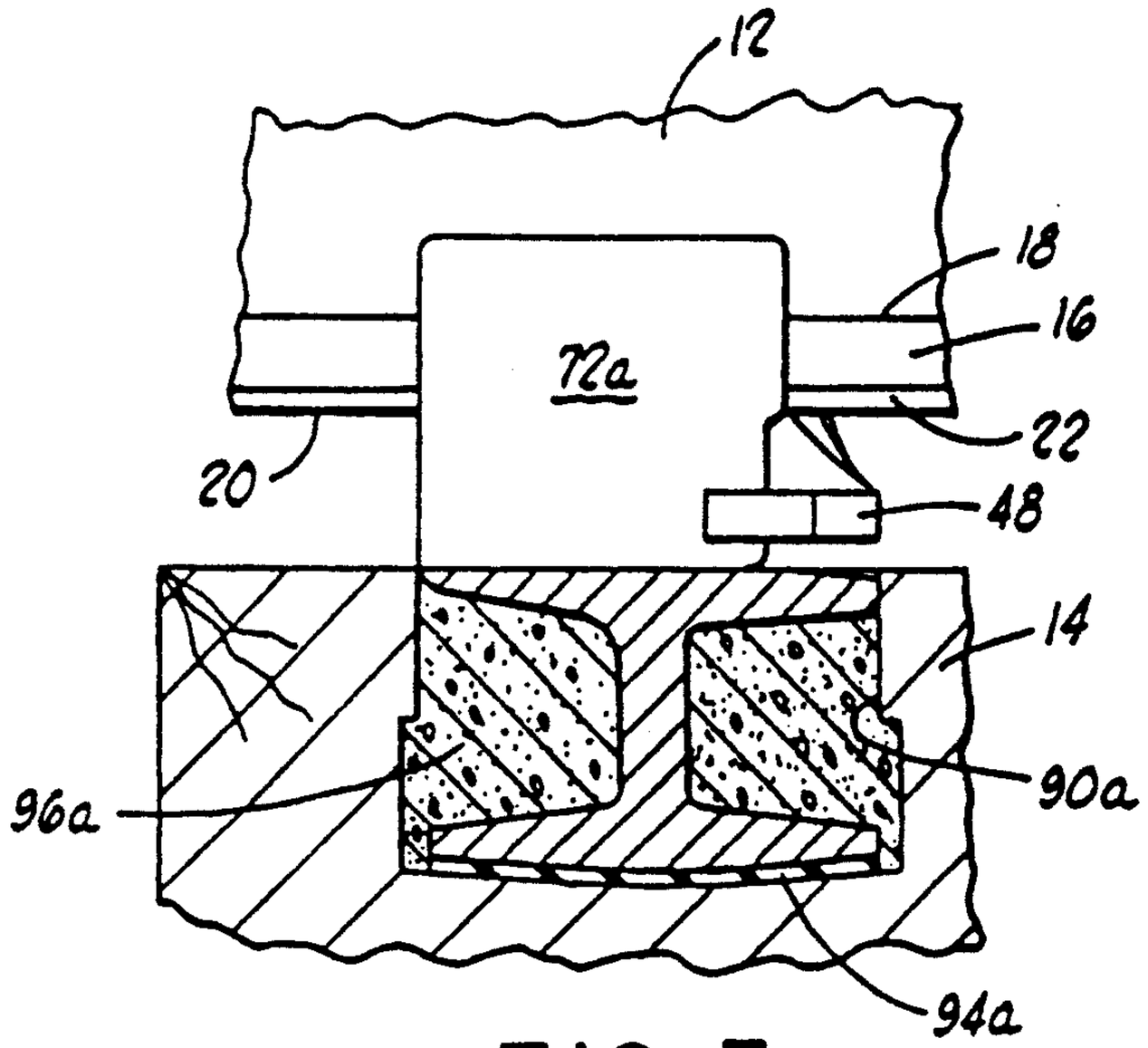
12
18
16
92a
22
20
48
14
90a
96a
94a

FIG. 3

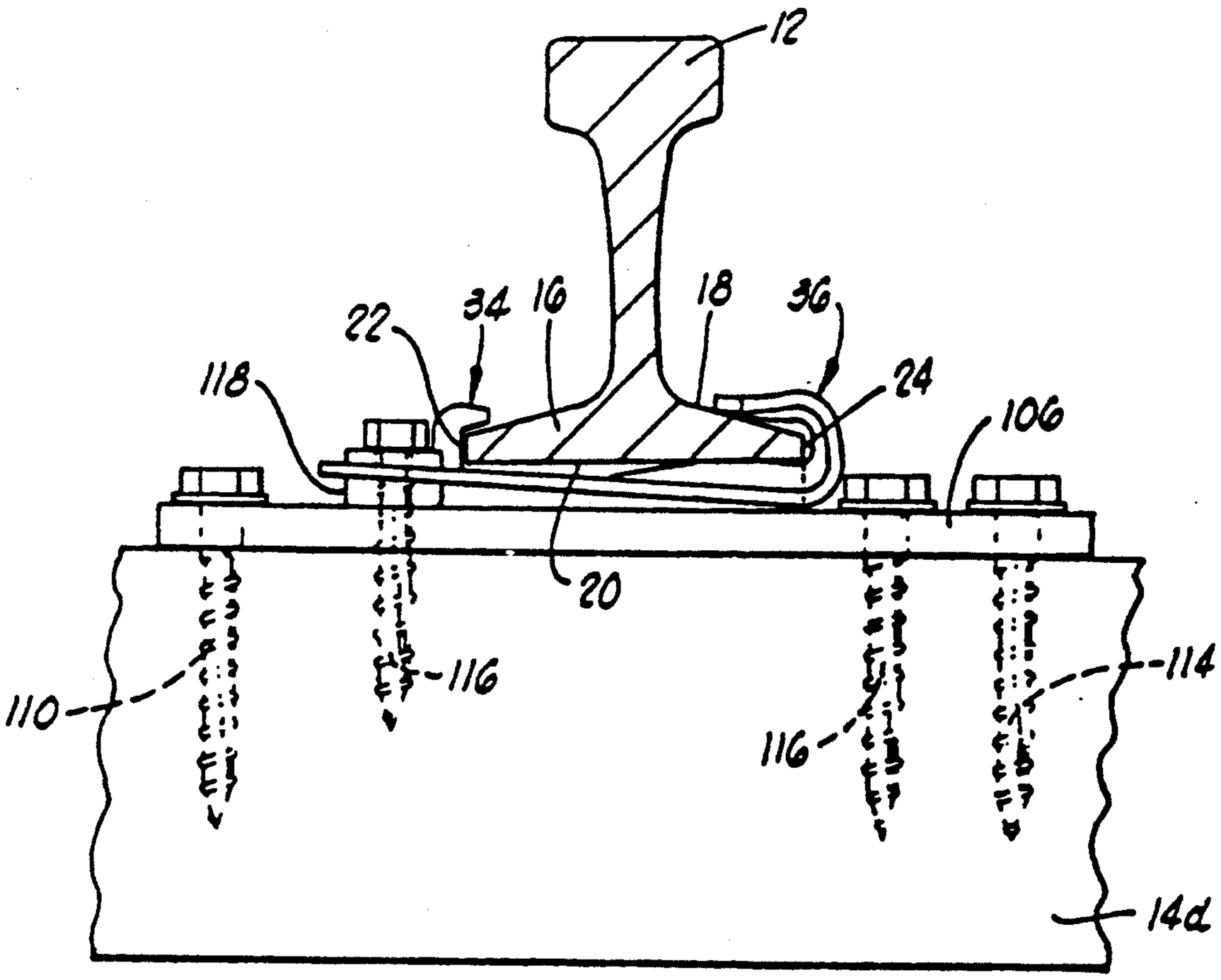
12
22
34
16
18
36
118
24
106
20
110
116
116
114
14d

FIG. 7

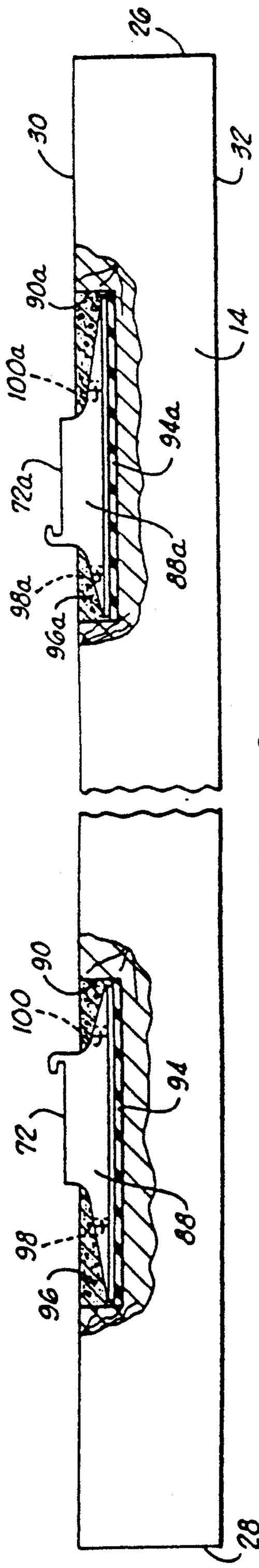

FIG. 4

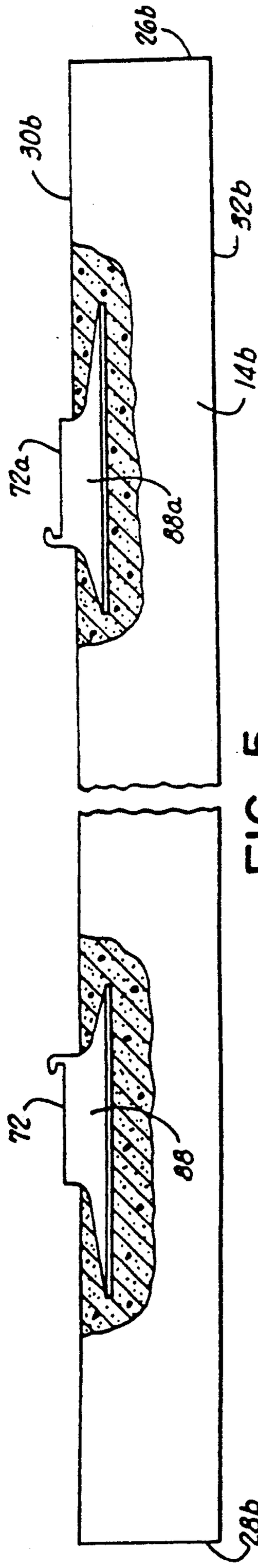

FIG. 5

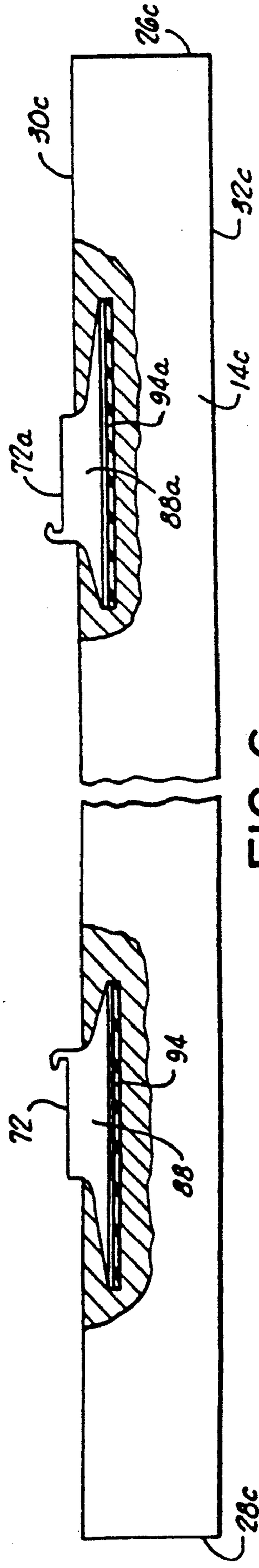

FIG. 6

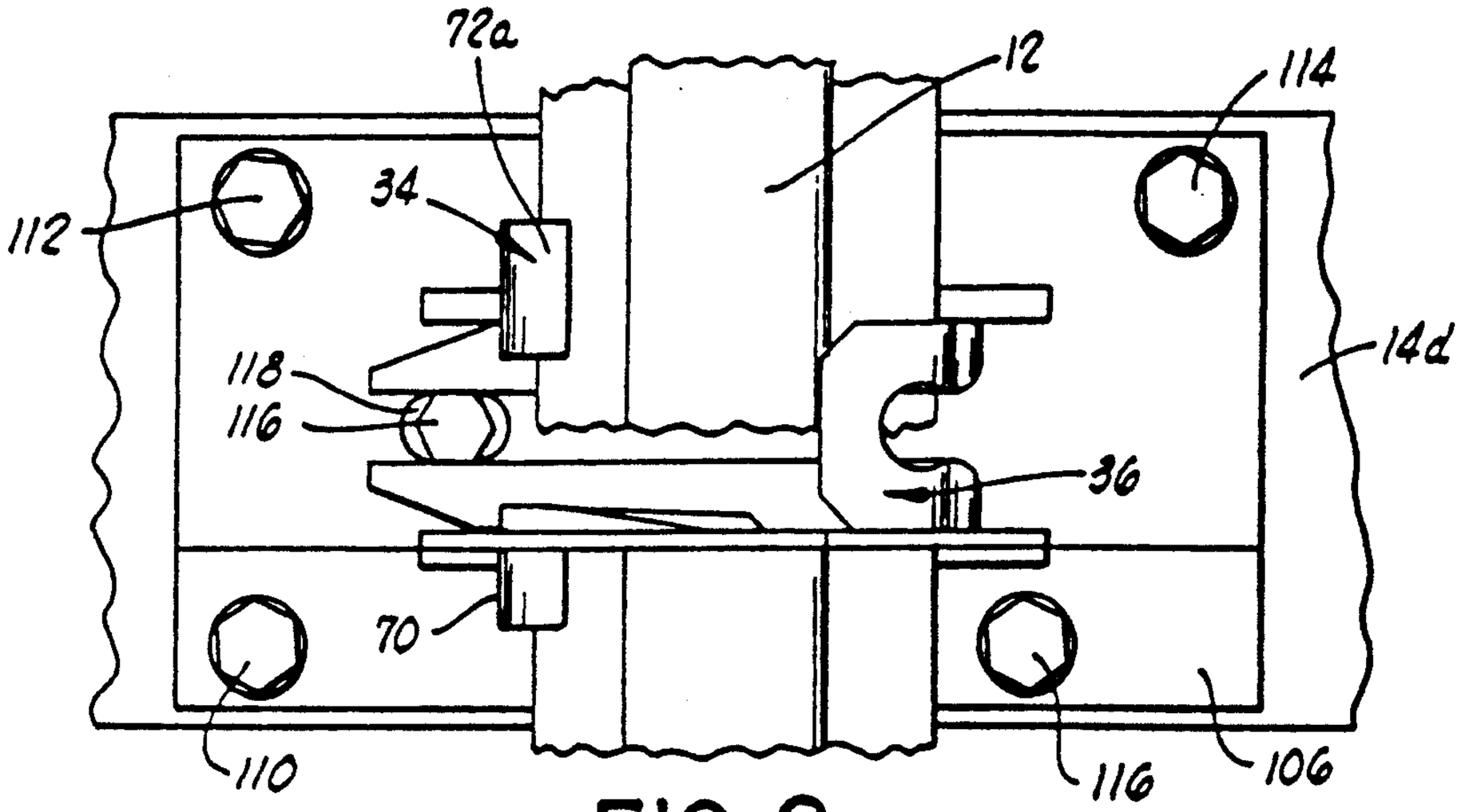
72a
12
114
112
34
118
116
14d
36
70
110
116
106

FIG. 8

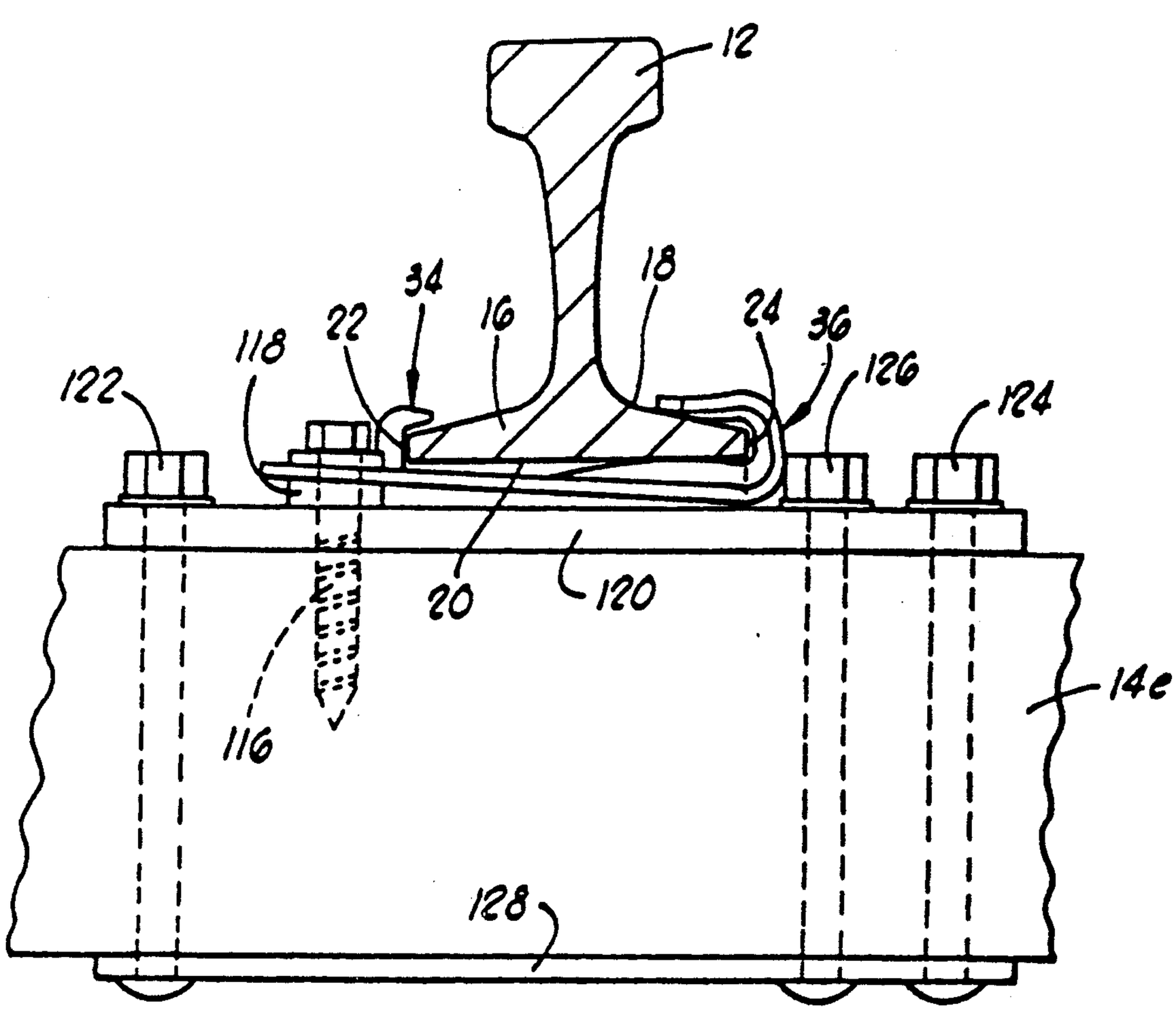
12
34
18
22
16
24
36
118
122
126
124
20
120
116
14c
128

FIG. 9

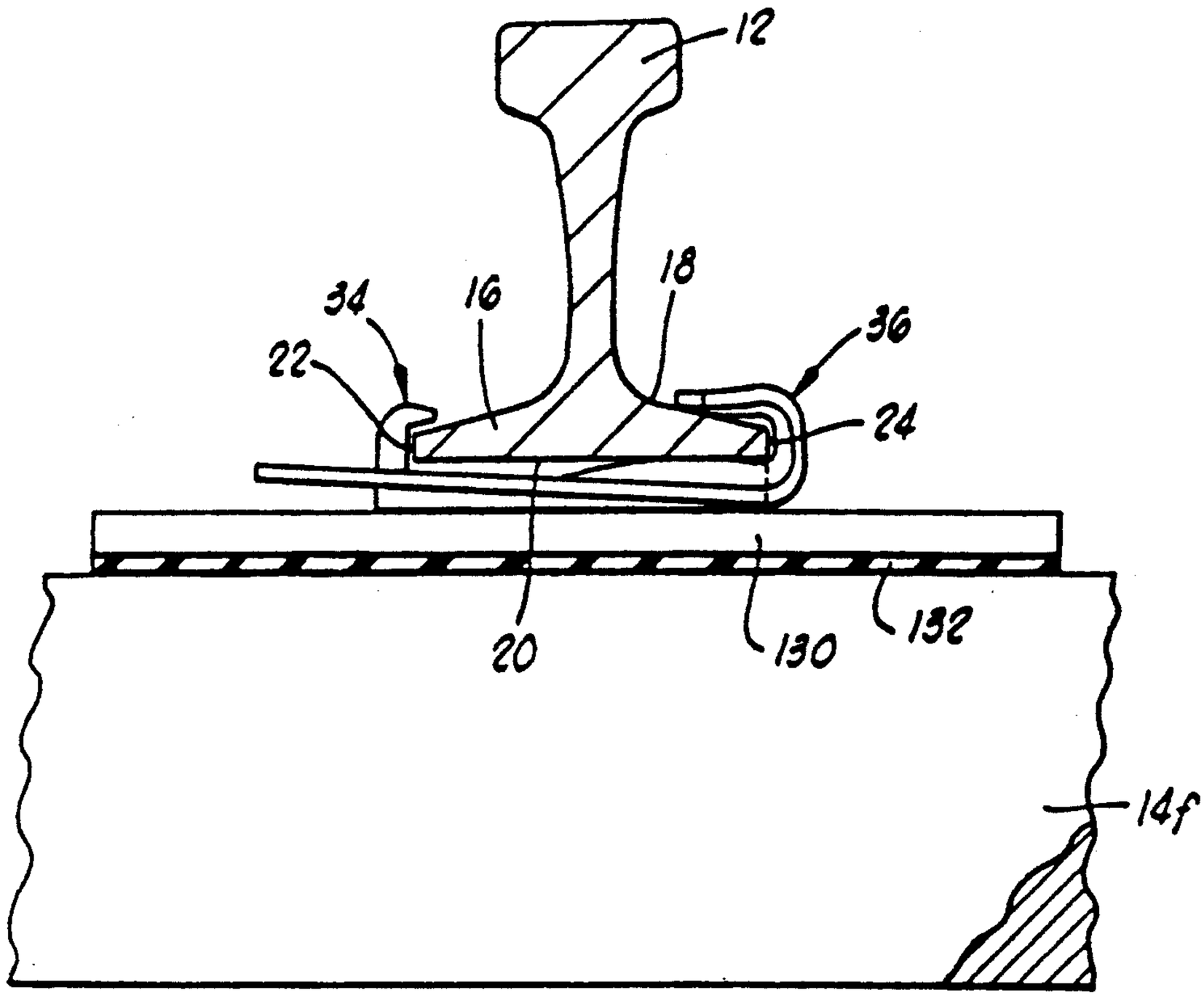

FIG. 10

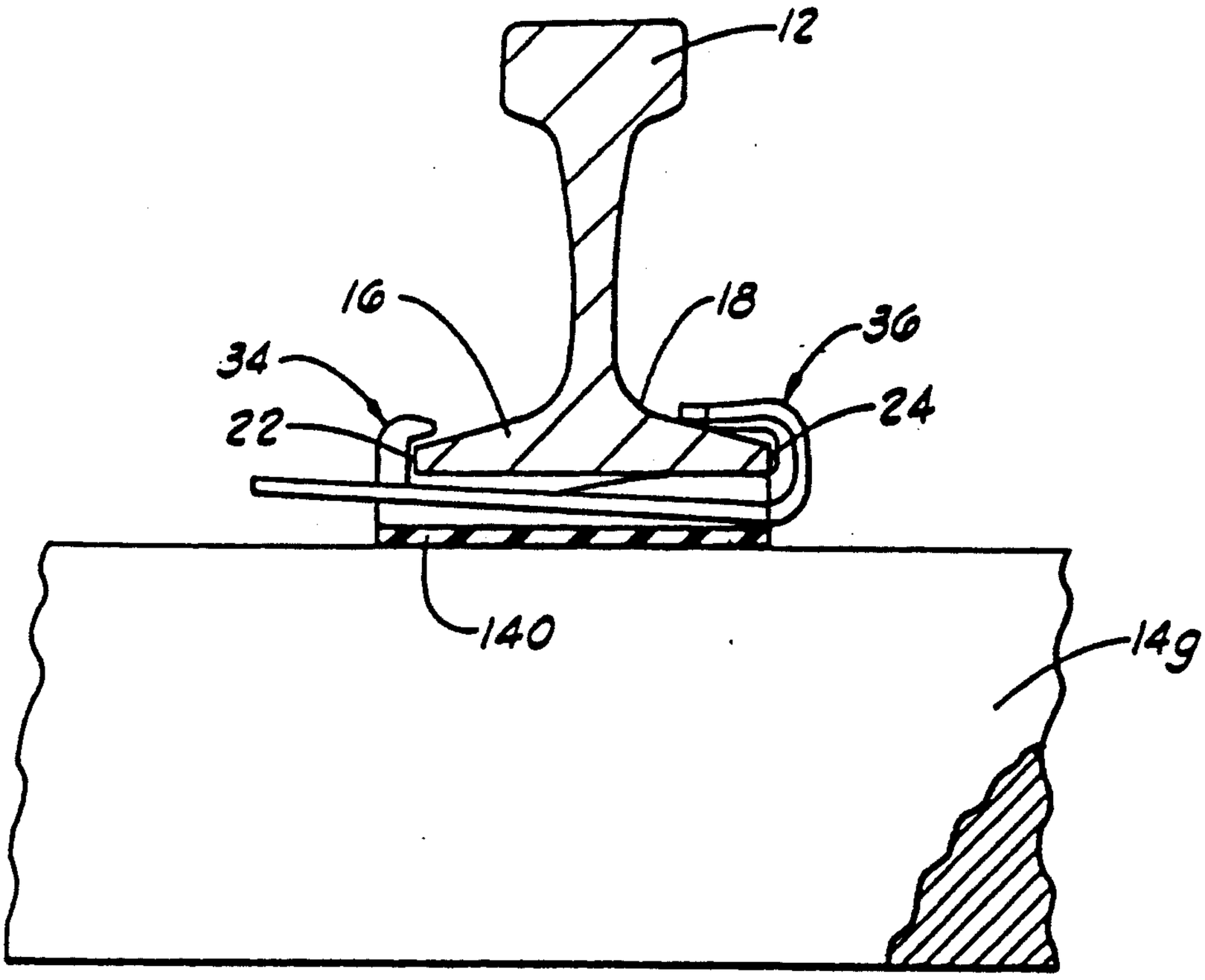

FIG. 11

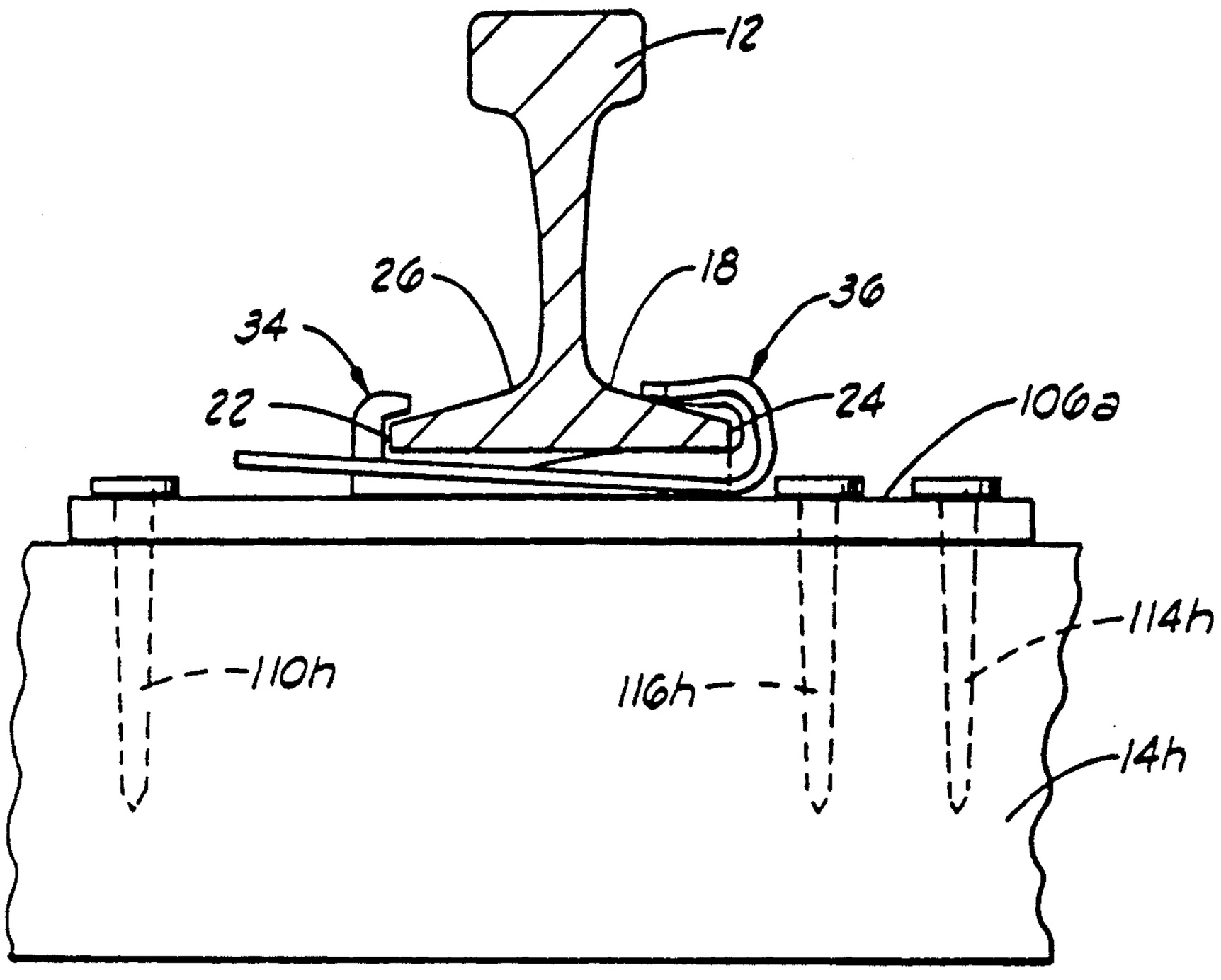

FIG. 12

METHOD FOR ADHESIVELY BONDING A RAIL-TIE FASTENING ASSEMBLY TO A WOODEN RAILWAY TIE

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation of application Ser. No. 07/414,226, filed Sept. 29, 1989, abandoned , which was a continuation-in part of application Ser. No. 07/128,174, filed on Dec. 3, 1987, now U.S. Pat. No. 4,874,128.

FIELD OF THE INVENTION

The present invention relates generally to fastening means for securing a railroad rail to a cross-tie. More particularly, but not by way of limitation, it relates to a rail-tie fastening assembly having a rail seat assembly connectable to the tie and a rail anchor removably insertable through a portion of and connectable to the rail seat assembly.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a top plan view of a rail-tie fastening assembly showing a rail seat assembly and a rail anchor in an unassembled position, but not showing a base anchor (shown in FIGS. **3**, **4**, **5** and **6**).

FIG. **2** is a side elevational view of the rail-tie fastening assembly of FIG. **1** showing the rail seat assembly and the rail anchor in the unassembled position, but not showing a base anchor (shown in FIGS. **3**, **4**, **5** and **6**).

FIG. **3** is a sectional view of a portion of a tie showing a portion of the base anchor used in the installation of the rail seat assembly on a wood tie.

FIG. **4** is a side elevational, partial sectional view of a tie with the two rail seat assemblies installed thereon, a base anchor being shown with each rail seat assembly for cooperating to anchor the rail seat assemblies to the wood tie.

FIG. **5** is a side elevational, partial elevational view of a concrete tie with two rail seat assemblies, a base anchor being shown with each rail seat assembly for cooperating to anchor the rail seat assemblies to the concrete tie.

FIG. **6** is a side elevational, partial elevational view of a composite wood tie with two rail seat assemblies, a base anchor being shown with each rail seat assembly for cooperating to anchor the rail seat assemblies to the composite wood tie.

FIG. **7** is a partial side elevational, partial sectional view showing a modified rail tie fastening assembly with the rail seat assembly bolted to a tie.

FIG. **8** is a top plan view of the modified rail tie fastening assembly of claim 7.

FIG. **9** is a partial side elevational, partial sectional view showing another modified rail tie fastening assembly bolted to a tie.

FIG. **10** is a partial side elevational, partial sectional view showing yet another modified rail tie fastening assembly.

FIG. **11** is a partial sectional, partial elevational view showing the rail seat assembly adhesively connected to the upper surface of a tie and showing the rail seat assembly and rail anchor connected to a rail.

FIG. **12** is a partial sectional, partial elevational view showing the rail seat assembly connected to a tie plate with the tie plate being connected to a tie via rail spikes and showing the rail seat assembly and the rail anchor connected to a rail.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in FIGS. **1**, **2**, **3** and **4**, the present invention comprises a rail-tie fastening assembly **10** which is adapted to connect a rail **12** (FIG. **3**) to a tie **14** (FIGS. **3** and **4**). The rail **12** (shown in FIG. **3**) includes a rail flange **16** having upper and lower surfaces **18** and **20** and a first side **22** and a second side **24** (FIG. **7**). As shown in FIG. **4**, the tie **14** has first and second ends **26** and **28** and upper and lower surfaces **30** and **32**. Each rail-tie fastening assembly **10** includes a rail seat assembly **34** (FIGS. **1** and **2**) and a rail anchor **36** (FIGS. **1** and **2**).

The rail anchor **36** has a first tine **38** having first and second ends **40** and **42** and first and second sides **44** and **46**. The rail anchor **36** also has a second tine **48** having first and second ends **50** and **52** and first and second sides **54** and **56**. The second ends **42** and **52** are connected together and the tines **40** and **48** extend in generally parallel planes. The second side **46** of the first tine **38** generally faces and is spaced a distance **58** from the second side **56** of the second tine **48**. The distance between the first side **44** of the first tine **38** and the first side **54** of the second tine **48** forms an anchor width **60**.

An anchor hook assembly **62** is connected to the second ends **42** and **52** of the first and second tines **38** and **48**. In this embodiment, the tines **38** and **48** are integrally constructed from a single unitary piece of metallic material.

A tapered portion **64** (FIG. **1**) is formed on the first side **44** of the first tine **38** generally near and intersecting the first end **40**. A tapered portion **66** (FIG. **1**) is formed on the first side **54** of the second tine **48**, generally near and intersecting the first end **50** of the second tine **48**.

A seat surface **68** (FIG. **1**) is formed on the first side **44** of the first tine **38**, generally near the beginning of the tapered portion **64**. A seat surface **70** (FIG. **1**) is formed on the first side **54** of the second tine **48**, generally near the beginning of the tapered portion **66**. The seat surfaces **68** and **70** cooperate to secure the rail anchor **36** within the rail seat assembly.

As shown more clearly in FIGS. **1** and **2**, the rail seat assembly **34** includes a first rail seat plate **72** having first and second ends **74** and **76** and first and second sides **78** and **80**. A first seat hook **82** is formed on the first end **74** of the first rail seat plate **72**. The first seat hook **82** is shaped and adapted to engage the first side **22** of the rail flange **16**.

As shown in FIG. **1**, the rail seat assembly **34** also includes a second rail seat plate **72*a*** which is constructed and operates exactly like the rail seat plate **72** described before, except the rail seat plates **72** and **72*a*** are left and right configuration adapted to be disposed on opposite sides of the rail anchor **36**. Thus, the various components of the rail seat plate **72*a*** are designated in the drawings with the same reference numerals as like components of the rail seat plate **72**, except the various components of the rail seat plate **72** also include the additional letter designation "a".

As shown in FIGS. **3** and **4**, the rail seat plates **70** and **72*a*** each are disposed generally on the upper surface **30** of the tie **14**. They are disposed generally in parallel extending planes. As shown more clearly in FIG. **1**, the second side **80** of the rail seat plate **72** is spaced a distance from the second side **80*a*** of the rail seat plate **72*a***.

The second sides **80** and **80***a* cooperate with the spacing therebetween to form an anchor slot **84** in the rail seat assembly **34**, and the distance between the second sides **80** and **80***a* comprises a slot width **86**.

As shown in FIGS. **3** and **4**, a base anchor **88** is connected to the lower surface of the rail seat plate **72**. A second base anchor **88***a* is connected to the lower surface of the rail seat plate **72***a*. The base anchors **88** and **88***a* have a generally I-shaped cross section (FIG. **3**).

In one embodiment, the base anchors **88** and **88***a* are formed integrally with the respective rail seat plates **72** and **72***a*.

As shown in FIG. **4**, a cavity **90** is formed in the upper surface **30** of the tie **14**. The cavity **90** is sized to receive the base anchor **88**. The cavity **90** and the base anchor **88** each are sized so that, when the base anchor **88** is disposed in the cavity **90**, the lower surface of the rail seat plate **72** is disposed in a plane generally coplanar with the upper surface **30** of the tie **14**.

A second cavity **90***a* (shown in FIG. **4**) is formed in the upper surface **30** of the tie **14** and the second cavity **90***a* is constructed and shaped exactly like the cavity **90**. The second cavity **90***a* is sized and shaped to receive the base anchor **88***a* for supporting the rail seat plate **72***a* in a manner exactly like that described before with respect to the cavity **90**, the base anchor **88** and the rail seat plate **72**.

To install the apparatus of the present invention, the two cavities **90** and **90***a* first are formed in the upper surface **30** of the tie **14**. The base anchor **88** along with the rail seat plate **72** connected thereto is disposed in the cavity **90** and the base anchor **88***a* along with the rail seat plate **72***a* connected thereto is disposed in the cavity **90***a*. The base anchors **88** and **88***a* each are positioned in the respective cavities **90** and **90***a* so that the rail seat plates **72** and **72***a* are oriented in the aligned, spaced apart manner described before. In this position, the base anchors **88** and **88***a* each are secured in the respective cavities **90** and **90***a* to secure the rail seat assembly **38** in the upper surface **30** of the tie **14**.

After the rail seat assembly **34** has been connected to the tie **14**, the rail flange **16** of the rail **12** is positioned generally on the upper surfaces of the rail seat plates **72** and **72***a*. The rail anchor **36** then is positioned so that the first ends **40** and **50** are disposed generally adjacent the anchor slot **84**.

In this position, the operator drives the rail anchor **36** in an insertion direction **92** (FIG. **1**). As the operator drives the rail anchor **36** in the insertion direction **92**, the tapered portions **64** and **66** engage the second sides **80** and **80***a* of the rail seat plates **72** and **72***a* thereby forcing the first ends **40** and **50** generally toward each other. The operator continues to drive the rail anchor **36** in the insertion direction **92** until the tapered portions **64** and **66** have been disposed entirely within the anchor slot **84**, thereby resulting in the first and the second tines **38** and **48** being moved generally toward each other to a position wherein the rail anchor **36** has been moved to a compressed position and the anchor width **60** has been reduced to about the same size as the slot width **86**.

In this compressed position of the rail anchor **36**, the operator continues to force or drive the rail anchor **36** in the insertion direction **92** until the seat surfaces **68** and **70** are moved slightly beyond the first ends **74** and **74***a* of the rail seats **72** and **72***a*. The seat surfaces **68** and **70** form a reduced width portion of the rail anchor **36** thereby permitting the second sides **46** and **56** to be moved apart to a position wherein the first and the second tines **38** and **48** return to a normal position. In the normal position, the seat surface **68** on the first tine **38** engages a portion of the first end **74** of the rail seat plate **72** and the seat surface **70** on the second tine **48** engages a portion of the first end **74***a* of the rail seat plate **72***a*, thereby securing the rail anchor **36** in the assembled position and in the normal position connected to the rail seat assembly **34**.

The anchor hook assembly **62** engages the second side **24** of the rail flange **16** and a portion of the anchor hook assembly **62** extends over a portion of the upper surface **18** of the rail flange **16** in the assembled position and in the normal position of the rail anchor **36** connected to the rail seat assembly **34**.

After connecting the rail seat assemblies **38** to the tie **14**, the tie **14** with the four rail seat assemblies **34** secured thereon is treated with creosote or any other suitable preservative in the case of wood ties **14**.

One system for securing the rail seat plate **72** in the cavity **90** is illustrated in FIGS. **3** and **4**. An epoxy adhesive **94** initially is disposed on the bottom surface of the cavity **90**. The base anchor **88** with the rail seat plate **72** connected thereto then is lowered into the cavity **90** to a position wherein the lower surface is disposed on the epoxy adhesive **94**. The remainder of the space in the cavity **90** not occupied by the base anchor **88** is filled with a potting compound **96**. The adhesive **94** and potting compound **96** are cured. The potting compound **96** cooperates with the epoxy adhesive **94** to fill the remaining space in the cavity **90** and to secure the base anchor **88** in the cavity **90**. The rail seat plate **72***a* is secured to the tie **14** in exactly the same manner.

As shown in FIG. **4**, each base anchor **88** and **88***a* includes at least two vent holes **98** and **100** and **98***a* and **100***a*, respectively. Each of the vent holes **98**, **100**, **98***a* and **100***a* extends through the base anchors **88** and **88***a*, respectively. Each of the vent holes **98**, **100**, **98***a* and **100***a* intersects the lower end of the respective base anchors **88** and **88***a*.

An excess amount of adhesive is disposed in the cavities **90** and **90***a*. The base anchors **88** and **88***a* with the respective rail seat plates **72** and **72***a* connected thereto are forced into the cavities **90** and **90***a*, respectively, against the epoxy adhesive **94** and **94***a*, respectively. The vent holes **98**, **100**, **98***a* and **100***a* aid in reducing air pockets in the adhesive **94** and **94***a*.

In one embodiment, the potting compound **96** is made by using the sawdust obtained from routing out of the cavities **90** and mixing the sawdust with a binding agent. The primer also can be placed on the wood surface to enhance bonding to the wood.

It should be noted that an epoxy primer can be disposed on the metal base anchor **88** to render the metal bondable to the epoxy adhesive **94** or the potting compound **96**.

The epoxy **94** must have a lap shear test value greater than 750 psig (as defined in Table I below), survive creosote treatment at about 200° F. for 8 to 10 hours, and survive temperature cycling from −20° F. to 120° F. for ten days. The epoxy **94** also must be suitable for about thirty years of outdoor service. Suitable epoxys are commercially available from Ciba Geigy and Fielro Industries.

To remove the rail anchor **36** from assemblage with the rail seat assembly **34**, the operator must move the first tine **38** and the second tine **48** generally toward each other to the compressed position wherein the seat surfaces **68** and **70** become disengaged from the first

ends **74** and **74***a* of the rail seat plates **72** and **72***a*. In this compressed position of the rail anchor **36**, the rail anchor **36** then can be moved in a removal direction **102** through the anchor slot **84** to a position wherein the rail anchor **36** is disengaged from the rail seat assembly **34**.

A rail tie fastening assembly constructed exactly like the rail tie fastening **10** described above was disclosed and claimed in the co-pending application entitled "Rail-Tie Fastening Assembly", U.S. application Ser. No. 128,174, filed on Dec, 3, 1987, now U.S. Pat. No. 4,874,128. The disclosure of this patent (U.S. patent application Ser. No. 128,174, now U.S. Pat. No. 4,874,128) specifically is incorporated herein by reference.

In an experiment, fifty test blocks, numbered one through 50 consecutively were prepared. Each test block was three inches square by four inches high. A rod hole having a 0.671 diameter was drilled into each test block and the rod hole was 2.0 inches deep. These samples were cut from air seasoned cross tie segments (some red oak and some white oak). The moisture content of six extra (not used) blocks was determined by drying in an oven at 104° C. to a constant weight. The average moisture content was 28.52% on an as received basis.

Forged steel rods were obtained having an average diameter of 0.640 inches, thereby providing a clearance of 0.015 between the steel rods and the bolt holes for accommodating the adhesive. The rod ends were coated with a releasing agent (paste wax) prior to bonding in order to prevent tensile bias of the lap shear test.

All of the test blocks bolt holes were dried by blowing hot air into each hole, except the test blocks identified in Table I below as "Control Samples". Hot air for drying was supplied by an electric plastic welding torch which was controlled through a powerstat. The drying temperatures and the hole temperatures were monitored with thermocouples disposed in preformed cavities in the test blocks.

The drying temperature was maintained in the range of from 110° C. to 120° C. and the drying time was thirty minutes. The wall and bottom temperatures in the bolt holes were 95° C. to 105° C. and 30° C. to 40° C., respectively.

After drying, epoxy was disposed in the rod holes. The rods then were inserted into the rod holes. Some of the samples (test blocks) were prepared using an epoxy Regency No. 24585 obtained from Fielco using 50 grams part "A" plus 25 grams part "B". Some of the samples (test blocks) were prepared using epoxy from Ciba-Geigy either LMH 276-8A' (epoxy A) or LMH 276-8B' (epoxy B) with a primer obtained from Ciba-Geigy LMH 276-14. After curing of the epoxy, some of the test blocks were treated with creosote.

Some of the test blocks were thermal conditioned by cycling such test blocks at −40° C. to 50° C. into an oven at 60° C. A one hour room temperature equilibration period was included between freezer and oven cycles. The conditioned test blocks were then submitted to shear testings (see Table II A and B below).

The test blocks, identified by number, are shown in Table I below along with an identification of the conditioning of each test block and a summary of the conditions under which the epoxy was cured.

TABLE I

Tag	Wood Type	Test Block Histories* Bonding	Conditioning
		Test Formula: Primer A Epoxy B	
1	Tie Red Oak	Room Temp	Creosoted, Temp cycled
2	Tie Red Oak	Room Temp	Creosoted
3	Tie Red Oak	Room Temp	Creosoted, Temp cycled
4	Tie Red Oak	Room Temp	Creosoted
5	Tie Red Oak	Room Temp	Creosoted
6	Tie Red Oak	2" water	Creosoted, Temp cycled
7	Tie White Oak	Room Temp	Creosoted
8	Tie White Oak	Room Temp	Creosoted, Temp cycled
9	Tie White oak	Room Temp	Creosoted
10	Tie White Oak	Room Temp	Creosoted, Temp cycled
11	Tie White Oak	Room Temp	Creosoted
12	Tie White Oak	Room Temp	Creosoted, Temp cycled
		Test Formula: Primer A Epoxy B	
13	Tie Red Oak	Room Temp	Creosoted, Temp cycled
14	Tie Red Oak	Room Temp	Creosoted
15	Tie Red Oak	Room Temp	Creosoted, Temp cycled
16	Tie Red Oak	Room Temp	Creosoted
17	Tie Red Oak	Room Temp	Creosoted
18	Tie Red Oak	2" water	Creosoted, Temp cycled
19	Tie White Oak	Room Temp	Creosoted
20	Tie White Oak	Room Temp	Creosoted, Temp cycled
21	Tie White Oak	Room Temp	Creosoted
22	Tie White Oak	Room Temp	Creosoted, Temp cycled
23	Tie White Oak	Room Temp	Creosoted
24	Tie White Oak	Room Temp	Creosoted, Temp cycled
		Test Formula: Fielco Regency 24585	
25	Tie Red Oak	Room Temp	Creosoted, Temp cycled
26	Tie Red Oak	Room Temp	Creosoted
27	Tie Red Oak	Room Temp	Creosoted, Temp cycled
28	Tie Red Oak	Room Temp	Creosoted
29	Tie Red Oak	Room Temp	Creosoted
30	Tie Red Oak	2" water	Creosoted, Temp cycled
31	Tie White Oak	Room Temp	Creosoted, Temp cycled
32	Tie White Oak	Room Temp	Creosoted
33	Tie White Oak	Room Temp	Creosoted
34	Tie White Oak	Room Temp	Creosoted
35	Tie White Oak	Room Temp	Creosoted, Temp cycled
		Test Formula: Control Samples Primer A Epoxy A	
36	Tie Red Oak	Room Temp	None
37	Tie Red Oak	Room Temp	None
38	Tie Red Oak	Room Temp	None
39	Tie White Oak	Room Temp	None
40	Tie White Oak	Room Temp	None
		Test Formula: Control Samples Primer A Epoxy B	
41	Tie Red Oak	Room Temp	None
42	Tie Red Oak	Room Temp	None
43	Tie White Oak	Room Temp	None
44	Tie White Oak	Room Temp	None
45	Tie White Oak	Room Temp	None
		Test Formula: Control Samples Fielco Regency 24585 Epoxy, No Primer	
46	Tie Red Oak		None
47	Tie Red Oak		None
48	Tie White Oak		None
49	Tie White Oak		None
50	Tie White Oak		None

*All bolt holes hot air dried three minutes
All samples stored in baggies throughout tests
Temperature cycling: −35° C. (overnight) to +60° C. (during day) with hour transition period between each hot and cold cycle; nine total cycles.

The rods had an eye formed in one end for use in lap shear pullout tests. The samples were assembled in a press adapted to maintain straight line pressure on the rods. The rods then were pulled from the test blocks and the pressure required to pull the rods from the test blocks was recorded. The results of these tests are summarized in Tables IIA, B and C below.

TABLE IIA

Lap Shear Strength Test Results
Control (ambient cure only)

Sample No.	Oak	Pullout Strength, psi 276-8A"	276-8B"	Fielco 24585
(36, 41, 46)	Red	1188	938	1210
(37, 42, 47)	Red	795	928	1250
(38, —, —)	Red	925	—	—
	Avg	970	933	1230
(39, 43, 48)	White	918	1445	1002
(40, 44, 49)	White	1073	1535	1002
(—, 45, 50)	White	—	1275	1178
	Avg	996	1418	1060

TABLE IIB

Lap Shear Strength Test Results
Creosote Treated

Sample No.	Oak	Pullout Strength, psi 276-8A"	276-8B"	Fielco 24585
2, 14, 26	Red	1775	1550	1438
4, 16, 28	Red	1508	1275	1512
5, 17, 29	Red	1480	1550	1812
	Avg	1588	1458	1587
7, 19, 32	White	1363	1575	1100
9, 21, 33	White	805	1456	1350
11, 23, 34	White	1530	1463	1300
	Avg	1233	1498	1250

TABLE IIC

Lap Shear Strength Test Results
Creosote + Temperature Cycled

Sample No.	Oak	Pullout Strength, psi 276-8A"	276-8B"	Fielco 24585
1, 13, 25	Red	1400	1175	1350
3, 16, 27	Red	1325	1500	1075
6, 18, 30	Red	1550	1388	1312
	Avg	1425	1354	1246
8, 20, 31	White	1288	1138	1090
10, 22, 35	White	900	1413	1250
12, 24, —	White	1250	1375	—
	Avg	1146	1309	1170

The average lap shear strengths (psi) can be summarized as follows in Table III below.

TABLE III

		Average Lap Shear Strengths (psi) Ciba-Geigy A"	B"	Fielco
Control (ambient cure only)	Red Oak	970	933	1230
	White Oak	996	1418	1060
Creosote Treatment	Red Oak	1588	1458	1587
	White Oak	1233	1498	1250
Creosote and thermal cycling	Red Oak	1425	1354	1246
	White Oak	1146	1309	1170

These test results indicate that significant increases in the strength of the epoxy bond are achieved by drying the tie to reduce the moisture content at least around portions of the tie where elements are to be epoxy bonded. These results indicate that the moisture content should be reduced to a moisture content below about 28% and, preferably, the moisture content should be reduced below about 20%. The surface of the tie is dried at a temperature above about 50° C.

As a result of the above test, the cavities **90** and **90***a* should be milled in the tie **12** and the at least the portion of the tie **12** generally around the cavities **90** and **90***a* should be dried to substantially reduce the moisture content at least in the portion of the tie **12** around the cavities **90** and **90***a* to about a 150" depth around the surface formed by the cavities **90** and **90***a*.

The moisture in the tie adversely affects the bonding ability of the epoxy. The drying significantly enhances such bonding ability.

In the embodiments described below where a tie plate is adhesively connected to the upper surface of the tie, at least the surface of the tie to which the tie plate is to be adhesively connected should be dried in accordance with the above procedure prior to adhesively connecting the tie plate to the tie.

The surface on the tie to which the base anchor or the tie plate is to be adhesively connected is dried for a period of time it reduce the surface moisture content to a level compatible with the epoxy being used. The drying time in a particular application preferably is sufficient to reduce the moisture content of the surface to below about 20%.

The term "surface" as used herein referring to the surface to which the rail-tie fastening assembly is to be adhesively connected means the outermost surface area of the tie and a portion of the tie immediately under the outermost surface area inwardly into the tie to a depth of about $\frac{1}{8}$ inch.

Embodiment of FIG. 5

Shown in FIG. **5** is the rail seat plates **72** and **72***a* connected to base anchors **88** and **88***a*, respectively, which are embedded in a tie **14***b* which is constructed of concrete. In this embodiment, the concrete tie **14***b* is formed in the usual manner well known in the art, except the concrete tie **14***b* is formed around the base anchors **88** and **88***a*.

Embodiment of FIG. 6

Shown in FIG. **6** is the rail seat plates **72** and **72***a* connected to base anchors **88** and **88***a*, respectively, which are embedded in a tie **14***a* which is constructed of a wood composite. In this embodiment, the wood composite tie **14***c* is formed around the base anchors **88** and **88***a*. A bonding agent may be required between the wood and metal parts so an epoxy primer **104** and **104***c* is placed on the lower surfaces of the base anchors **88** and **88***a* prior to forming the wood composite tie **14** about the base anchors **88** and **88***a*. The wood composite is made by grinding wood to provide a ground wood supply, drying the ground wood supply to provide a dried ground wood supply and, then, mixing the dried ground wood supply with a bonding agent to provide a wood mixture. The wood mixture is formed or molded around the base anchors **88** and **88***a*.

Embodiment of FIGS. 7 and 8

Shown in FIGS. **7** and **8** is the rail seat assembly **34** and the rail anchor **36** constructed in the manner described before connected to a tie **14***d*. The rail seats **72** and **72***a* are welded or adhesively connected to a tie plate **106**. The tie plate **106** is connected to the upper surface of the tie **14***d* via four screws or other suitable attachment means **108**, **110**, **112** and **114**. In this embodiment, the rail seat assembly **34** and the rail anchor **36** are connected to the upper surface of the tie **14***d* via the tie plate **106** and base anchors embedded in the tie like the base anchors **88** described before are not utilized.

A screw **116** extended through a stop head **118** is disposed through the tie plate **106** and through a portion of the tie **14***d*. The screw **116** is disposed so that the stop

head **118** is positioned between the tines **38** and **148** in the assembled position of the rail seat assembly **34** and the rail anchor **36** and in the normal position of the rail anchor **36**. The stop head **118** prevents the tines **38** and **48** from being inadvertently moved to the compressed position, thereby providing additional assurance that the rail anchor **36** will remain connected to the rail seat assembly **34**. To remove the rail anchor **36**, it first is necessary to remove the stop head **118** and, then, the tines **38** and **48** can be moved to the compressed position and disassembled from the rail seat assembly **34**.

The stop head **118** can be used with the rail-tie fastening assembly **10** shown in FIGS. **1**, **2**, **3** and **4** and described in detail before.

Embodiment of FIG. **9**

Shown in FIG. **9** is the rail seat assembly **34** and the rail anchor **36** constructed in the manner described before connected to a tie **14***e*. The rail seats **72** and **72***a* are welded or adhesively connected to a tie plate **120**. The tie plate **120** is connected to the upper surface of the tie **14***e* via four bolts or other suitable attachment means, only three bolts **122**, **124** and **126** being shown in FIG. **9**. The bolts **122**, **124** and **126** extend through the tie plate **120** and through the tie **14***e* and a distance beyond the lower surface of the tie **14***e*.

A lower tie plate **128** is disposed adjacent the lower surface of the tie **14***e*. The bolts **122**, **124** and **126** also extend through the lower tie plate **128** and the bolts **122**, **124** and **126** are connected to the lower tie plate **128**.

Embodiment of FIG. **10**

Shown in FIG. **10** is the rail seat assembly **34** and the rail anchor **36** constructed in a manner described before connected to a tie **14***f*. The rail seats **72** and **72***a* are welded or adhesively connected to a tie plate **130**. The tie plate **130** is disposed on the upper surface of the tie **14***f*. The tie plate **130** is connected to the tie **14***f* via an epoxy adhesive **132**.

Embodiment of FIG. **11**

Shown in FIG. **11** is the rail seat plate **72** or **72***a* connected to the upper surface of a tie **14***g* by way of an adhesive **140** in this embodiment, both of the rail seat plates **72** and **72***a* are directly connected to the upper surface of the tie **14***g* by way of the adhesive **140**. The tie **14***g* as shown in FIG. **11** is a steel tie.

Embodiment of FIG. **12**

Shown in FIG. **12** is the rail seat assembly **34** and the rail anchor **36** connected to a tie plate **106***a*. The tie plate **106***a* is connected to the tie **14***h* by way of four spikes (only three of the spikes being shown in FIG. **12** and designated therein by the reference numerals **110***h*, **114***h* and **116***h*). The tie plate **106***a* is constructed like the tie plate **106** shown in FIG. **7** and described before, except the tie plate **106***a* is connected to the rail **14***h* by way of the spikes **110***h*, **114***h* and **116***h* instead of the screws shown in FIG. **7**.

Changes may be made in the various components, elements and assemblies described herein and changes may be made in the steps or sequence of steps of the methods described herein without departing from the spirit and the scope of the invention as define in the following claims.

What is claimed is:

1. A method for connecting a rail-tie fastening assembly to a surface of a wood tie, wherein the rail-tie fastening assembly comprises a base anchor means and means attached to the base anchor means for connecting said base anchor means to a rail, comprising:

forming a cavity in the tie sized for accommodating the base anchor means;

drying only an outermost surface of the cavity and a portion of the tie immediately inward into the tie under the outermost surface at a temperature above 50° C. for a period of time sufficient to reduce the moisture content in said surface, which is initially greater than 28 percent by weight, to a level below 28 percent by weight for strengthening an adhesive bond between the base anchor means and the tie;

disposing epoxy adhesive on said surface of the cavity;

disposing the base anchor means in the cavity and on said surface of the cavity in contact with the epoxy adhesive; and

permitting the epoxy adhesive to cure for adhesively connecting and bonding the base anchor means to the tie, the epoxy adhesive being the only means for connecting the base anchor means to the tie.

2. The method of claim **1** wherein the step of drying further comprises the drying for a period of time sufficient to reduce the moisture content in said surface below 20 percent by weight.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 5,160,084

DATED : November 3, 1992

INVENTOR(S) : S. Hudson Owen, Roger A. Baldwin, Gerald E. Taylor, and Paul A. Wolff

It is certified that error appears in the above-indentified patent and that said Letters Patent is hereby corrected as shown below:

Column 8, line 1, delete "150"" and insert --1/8"--

Signed and Sealed this

Seventh Day of October, 1997

Attest:

BRUCE LEHMAN

Attesting Officer

Commissioner of Patents and Trademarks

Disclaimer and Dedication

5,160,084—S. Hudson Owen, Marshfield, Wis.; Roger A. Baldwin, Warr Acres, Okla.; Gerald E. Taylor; Paul A. Wolff, Oklahoma City, Okla. METHOD FOR ADHESIVELY BONDING A RAIL-TIE FASTENING ASSEMBLY TO A WOODEN RAILWAY TIE. Patent dated Nov. 3, 1992. Disclaimer and dedication filed Apr. 30, 2003, by the assignee, Kerr-McGee Chemical LLC.

Hereby disclaims and dedicates to the Public, the remaining term of said patent.

(Official Gazette, August 12, 2003)